AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended): A fiberoptic sensor for measuring at least one electric current or magnetic field, having

______a light source,

______N sensor heads that can be arranged in the shape of a coil around current conductors or along the magnetic field, N being a whole number with $N \geq 2$[[,]];

~~at least~~ exactly one phase modulation unit, having at least one phase modulator[[,]];

______at least one detector~~, and~~;

______a control and evaluation unit that is connected via at least one detector signal line to the at least one detector, and via at least one modulator signal line to the at least one phase modulator[[,]];

______first means being provided for guiding light from the light source into an end, on the detector side, of the phase modulation unit[[,]];

______second means being available for guiding light from the end, on the detector side, of the phase modulation unit to the detector[[,]];

______wherein the ~~at least one~~ phase modulation unit ~~having~~ has a further end, on the sensor head side, that is optically connected to at least one of the N sensor heads, and

N reflection interferometers are provided, each of the N reflection interferometers includes exactly one of the N sensor heads, and the N sensor heads in each case having a mirrored end[[.]], and

______wherein by means of the ~~at least one~~ phase modulation unit linearly polarized lightwaves can be phase-modulated differentially in a non-reciprocal fashion, wherein N modulation amplitudes $\phi_{0,n}$ and N modulation frequencies ν_n are provided for the non-reciprocal differential phase modulations, the modulation frequencies ν_n and two prescribable positive whole numbers p, q with $p \neq q$ being selected in such a way that ~~it holds~~the following equation is fulfilled for all positive whole numbers z and for all whole numbers n, m with $n \neq m$ and $1 \leq n,m \leq N$ that:

$$\cancel{p \bullet \nu_n \neq z \bullet \nu_m}\ \underline{p \times \nu_n \neq z \times \nu_m} \text{ and}$$

$$\cancel{q \bullet \nu_n \neq z \bullet \nu_m}\ \underline{q \times \nu_n \neq z \times \nu_m}$$

and the modulation amplitudes $\phi_{0,n}$ and the modulation frequencies ν_n being selected as a function of modulation-relevant optical path lengths ℓ_n.

2. (Currently Amended): The sensor as claimed in claim 1, wherein exactly one control and evaluation unit is provided, in which signals that originate from the various sensor heads and are fed to the control and evaluation unit via the at least one detector signal line can be distinguished from one another by means of frequency filtering, it being possible to convert these signals into N output signals S_n, in particular it being possible to determine the output signals S_n for each n with $1 \leq n$

$\leq$ N from signals at the frequencies ~~p•ν_n~~ p × ν_n and ~~q•ν_n~~ q × ν_n in the control and evaluation unit.

3. (Currently Amended): The sensor as claimed in claim 1, wherein ~~exactly one phase modulation unit is provided, and in that N reflection interferometers are provided, each of the N reflection interferometers including exactly one of the N sensor heads, and the N sensor heads in each case having a mirrored end~~the light source is connected to the control and evaluation unit via a light control signal line, and in that a time division multiplexing method is provided for the measurement.

4. (Currently Amended): The sensor as claimed in claim ~~3~~1, wherein ~~the light source is connected to the control and evaluation unit via a light control signal line, and in that a time division multiplexing method is provided for the measurement~~the phase modulation unit either (a) is a modulator circuit having N phase modulators, in particular piezoelectric phase modulators, each of the N phase modulators being assigned to exactly one of the N modulation frequencies ν_n, and wherein each of the N phase modulators can be operated at the modulation frequency ν_n assigned to it, and wherein the differential phase of oppositely directed lightwaves polarized parallel to one another can be modulated, or

(b) includes a single phase modulator, configured as an integrated optical phase modulator, which permits a simultaneous phase modulation with the N various modulation frequencies ν_n, and it being possible to modulate the differential phase of lightwaves that propagate in the same direction and are mutually orthogonally polarized.

5. (Currently Amended): The sensor as claimed in ~~claim 3~~ claim 4, wherein ~~the phase modulation unit either (a) is a modulator circuit having N phase modulators, in particular piezoelectric phase modulators, each of the N phase modulators being assigned to exactly one of the N modulation frequencies ν_n, and wherein each of the N phase modulators can be operated at the modulation frequency ν_n assigned to it, and wherein the differential phase of oppositely directed lightwaves polarized parallel to one another can be modulated, or (b) includes a single phase modulator, configured as an integrated optical phase modulator, which permits a simultaneous phase modulation with the N various modulation frequencies ν_n, and it being possible to modulate the differential phase of lightwaves that propagate in the same direction and are mutually orthogonally polarized~~ selection p = 1 and q = 2 is made, wherein the N modulation amplitudes $\phi_{0,n}$ and the N modulation frequencies ν_n are selected in such a way that amplitudes $\alpha_{0,n}$ of the modulation of the differential phase of the linearly polarized lightwaves lie between 1.7 and 2.0, in particular between 1.8 and 1.88, or are essentially 1.84 for all n with $1 \leq n \leq N$.

6. (Currently Amended): The sensor as claimed in ~~claim 1~~ claim 5, wherein ~~N phase modulation units having one phase modulator each are provided, the nth phase modulation unit being optically connected to the nth sensor head, and it being possible to operate the nth phase modulator with the modulation frequency ν_n, and each of the phase modulators being connected to the control and evaluation unit via one modulator signal line each~~ either

(a) exactly one detector is provided, or

(b) N detectors are provided, each of the detectors being connected to the control and evaluation unit via one detector signal line each.

7. (Currently Amended): ~~The sensor as claimed in claim 6, wherein N reflection interferometers are provided, each of the N reflection interferometers comprising exactly one of the N sensor heads, and the N sensor heads in each case having a mirrored end, and~~

~~wherein either~~

~~(a) the phase modulation units are modulator circuits, and wherein it is possible to modulate the differential phase of oppositely directed lightwaves polarized parallel to one another by means of the phase modulators, and wherein the phase modulators are piezoelectric phase modulators, or~~

~~(b) each of the phase modulators can modulate the differential phase of mutually orthogonally polarized lightwaves propagating in the same direction and, wherein the phase modulators are integrated optical phase modulators~~A fiberoptic sensor for measuring at least one electric current or magnetic field, comprising:

a light source;

N sensor heads that can be arranged in the shape of a coil around current conductors or along the magnetic field, N being a whole number with $N \geq 2$;

at least one phase modulation unit, having at least one phase modulator;

at least one detector;

a control and evaluation unit that is connected via at least one detector signal line to the at least one detector, and via at least one modulator signal line to the at least one phase modulator;

first means being provided for guiding light from the light source into an end on the detector side, of the phase modulation unit;

second means being available for guiding light from the end, on the detector side, of the phase modulation unit to the detector the at least one phase modulation unit having a further end, on the sensor head side, that is optically connected to at least one of the sensor heads, and

wherein N phase modulation units having one phase modulator each are provided, the nth phase modulation unit being optically connected to the nth sensor head, and it being possible to operate the nth phase modulator with the modulation frequency ν_n, and each of the phase modulators being connected to the control and evaluation unit via one modulator signal line each, and

wherein by means of the at least one phase modulation unit linearly polarized lightwaves can be phase-modulated differentially in a non-reciprocal fashion, wherein N modulation amplitudes $\phi_{0,n}$ and N modulation frequencies ν_n are provided for the non-reciprocal differential phase modulations, the modulation frequencies ν_n and two prescribable positive whole numbers p, q with $p \neq q$ being selected in such a way that the following equation is fulfilled for all positive whole numbers z and for all whole numbers n, m with $n \neq m$ and $1 \leq n,m \leq N$ that:

$$p \times \nu_n \neq z \times \nu_m \text{ and}$$

$$q \times \nu_n \neq z \times \nu_m.$$

and the modulation amplitudes $\phi_{0,n}$ and the modulation frequencies ν_n being selected as a function of modulation-relevant optical path lengths ℓ_n.

8. (Currently Amended): ~~The sensor as claimed in claim 6, wherein N Sagnac interferometers are provided, each of the N Sagnac interferometers including exactly one of the N sensor heads, and~~
~~wherein each of the phase modulation units is essentially one phase modulator each, it being possible to modulate the differential phase of oppositely directed lightwaves, polarized parallel to one another, by means of the phase modulators, and~~
~~wherein the phase modulators are piezoelectric phase modulators or integrated optical modulators~~The sensor as claimed in claim 7, wherein N reflection interferometers are provided, each of the N reflection interferometers comprising exactly one of the N sensor heads, and the N sensor heads in each case having a mirrored end, and wherein either

(a) the phase modulation units are modulator circuits, and wherein it is possible to modulate the differential phase of oppositely directed lightwaves polarized parallel to one another by means of the phase modulators, and wherein the phase modulators are piezoelectric phase modulators, or

(b) each of the phase modulators can modulate the differential phase of mutually orthogonally polarized lightwaves propagating in the same direction and, wherein the phase modulators are integrated optical phase modulators.

9. (Currently Amended): ~~The sensor as claimed in claim 1, wherein selection p = 1 and q = 2 is made, and in that the N modulation amplitudes $\phi_{0,n}$ and the N modulation frequencies ν_n are selected in such a way that amplitudes $\alpha_{0,n}$ of the modulation of the differential phase of the linearly polarized lightwaves lie between 1.7 and 2.0, in particular between 1.8 and 1.88, or are essentially 1.84 for all n with 1 ≤ n ≤ N~~The sensor as claimed in claim 7, wherein N Sagnac interferometers are provided, each of the N Sagnac interferometers including exactly one of the N sensor heads, and

wherein each of the phase modulation units is essentially one phase modulator each, it being possible to modulate the differential phase of oppositely directed lightwaves, polarized parallel to one another, by means of the phase modulators, and

wherein the phase modulators are piezoelectric phase modulators or integrated optical modulators.

10. (Currently Amended): ~~The sensor as claimed in claim 1, wherein either (a) exactly one detector is provided, or~~

~~(b) N detectors are provided, each of the detectors being connected to the control and evaluation unit via one detector signal line each~~The sensor as claimed in claim 9, wherein selection p = 1 and q = 2 is made, and in that the N modulation amplitudes $\phi_{0,n}$ and the N modulation frequencies ν_n are selected in such a way that amplitudes $\alpha_{0,n}$ of the modulation of the differential phase of the linearly polarized lightwaves lie between 1.7 and 2.0, in particular between 1.8 and 1.88, or are essentially 1.84 for all n with $1 \leq n \leq N$.

11. (Currently Amended): ~~The sensor as claimed in claim 1, wherein N = 3 or N = 6, and the electric currents of three phases of an electric high voltage system can be measured by means of one sensor head each in the case of N = 3, or being able to be measured by means of two sensor heads each in the case of N = 6~~The sensor as claimed in claim 10, wherein either

(a) exactly one detector is provided, or

(b) N detectors are provided, each of the detectors being connected to the control and evaluation unit via one detector signal line each.

12. (withdrawn): A method for measuring at least one electric current or at least one magnetic field, a light source emitting lightwaves that are converted into linearly polarized lightwaves, and

the linearly polarized lightwaves being guided into N sensor heads in which the lightwaves undergo a phase shift, which phase shift depends on the current or magnetic field to be measured, N being a whole number with $N \geq 2$, and

the lightwaves being detected in at least one detector, and

the lightwaves undergoing a non-reciprocal differential phase modulation in at least one phase modulation unit having at least one phase modulator, the at least one phase modulation unit being traversed by the lightwaves both during their propagation from the light source to the sensor heads and during their propagation from the sensor heads to the at least one detector, and

a control and evaluation unit being used both to control the at least one phase modulator and to evaluate signals originating from the at least one detector, wherein

the lightwaves are differentially phase-modulated in a non-reciprocal fashion with N modulation amplitudes $\phi_{0,n}$ and N modulation frequencies ν_n, the modulation frequencies ν_n and two prescribable positive whole numbers p, q with $p \neq q$ being selected in such a way that it holds for all positive whole numbers z and for all whole numbers n, m with $n \neq m$ and $1 \leq n,m \leq N$ that:

$$p \bullet \nu_n \neq z \bullet \nu_m \text{ and}$$

$$q \bullet \nu_n \neq z \bullet \nu_m,$$

and the modulation amplitudes $\phi_{0,n}$ and the modulation frequencies ν_n being selected as a function of modulation-relevant optical path lengths ℓ_n.

13. (New): A fiberoptic sensor for measuring at least one electric current or magnetic field comprising:

a light source;

N sensor heads that can be arranged in the shape of a coil around current conductors or along the magnetic field, N being a whole number with $N \geq 2$, wherein when N = 3 or N = 6, and the electric currents of three phases of an electric high voltage system can be measured by means of one sensor head each in the case of N = 3, or being able to be measured by means of two sensor heads each in the case of N = 6;

at least one phase modulation unit, having at least one phase modulator,

at least one detector;

a control and evaluation unit that is connected via at least one detector signal line to the at least one detector, and via at least one modulator signal line to the at least one phase modulator;

first means being provided for guiding light from the light source into an end, on the detector side, of the phase modulation unit;

second means being available for guiding light from the end, on the detector side, of the phase modulation unit to the detector, the at least one phase modulation unit having a further end, on the sensor head side, that is optically connected to at least one of the sensor heads, and

wherein by means of the at least one phase modulation unit linearly polarized lightwaves can be phase-modulated differentially in a non-reciprocal fashion, wherein N modulation amplitudes $\phi_{0,n}$ and N modulation frequencies ν_n are provided for the non-reciprocal differential phase modulations, the modulation frequencies ν_n and two prescribable positive whole numbers p, q with $p \neq q$ being selected in such a way that the following equation is fulfilled for all positive whole numbers z and for all whole numbers n, m with $n \neq m$ and $1 \leq n,m \leq N$ that:

$$p \times \nu_n \neq z \times \nu_m \text{ and}$$

$$q \times \nu_n \neq z \times \nu_m$$

and the modulation amplitudes $\phi_{0,n}$ and the modulation frequencies ν_n being selected as a function of modulation-relevant optical path lengths ℓ_n.